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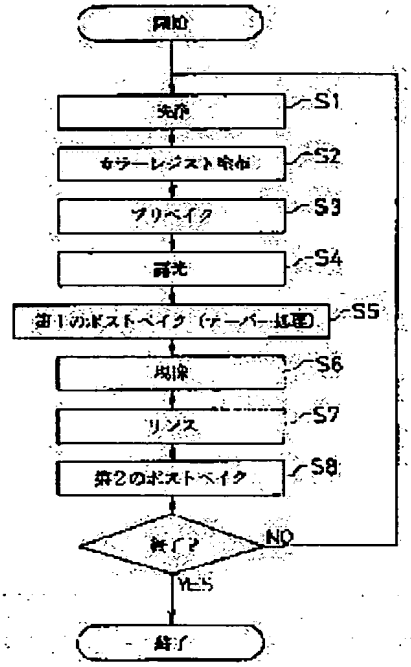
(54) PRODUCTION OF COLOR FILTER AND COLOR LIQUID CRYSTAL DISPLAY DEVICE

(57)Abstract:
PURPOSE: To produce a color filter for liquid crystal display device which can display a high quality image.
CONSTITUTION: A color resist film is formed (S2), prebaked (S3), and exposed by using a photomask (S4). After exposure, the film is subjected to first postbaking (S5) and developed to form a color filter (S6). The formed color filter is baked (S8) to complete the color filter. These steps are repeated for every color of color filter having three colors R, G, B to obtain the objective color filter. By controlling the baking temp. in the prebaking step and the baking temp. in the first post baking step, the angle of a taper formed on the edge of the color filter can be controlled and the taper angle optimum for the thickness of the color filter can be set.



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[Claim(s)]
[Claim 1] The process which forms the sensitive-material film for light filter formation, and the process which prebakes said sensitive-material film, At the exposure process which exposes said sensitive-material film using the predetermined photo mask corresponding to the configuration of the light filter to form, and the temperature according to the include angle of the taper formed in the edge of the light filter to form The 1st postbake process which bakes said exposed sensitive-material film, The manufacture approach of the light filter characterized by what the development process which develops said sensitive-material film by which postbake was carried out, and the 2nd postbake process which carries out postbake of said developed sensitive-material film are provided, and the light filter which has a taper is formed in an edge for.
[Claim 2] The baking temperature in said 1st postbake process is the manufacture approach of the light filter [higher than the baking temperature in said prebaking process] according to claim 1 characterized by things.
[Claim 3] tantheta of the include angle theta of the taper of each aforementioned light filter The thickness of a light filter At the time 1.0 micrometers or more of less than 1.2 micrometers, 1.2 micrometers or more less than 1.4 micrometers, 1.4 micrometers or more less than 1.6 micrometers, 1.6 micrometers or more less than 1.8 micrometers, and 1.8 micrometers or more The manufacture approach of the light filter according to claim 1 or 2 characterized by or more 0.08 the thing which it is 0.10 or less, 0.125 or less [0.11 or more], 0.16 or less [0.13 or more], 0.20 or less [0.18 or more], and 0.30 or less [0.21 or more], respectively.
[Claim 4] The process prebaked according to the include angle of the process which forms the sensitive-material film for light filter formation, and the taper which forms said sensitive-material film in the edge of the light filter to form at the temperature of the 60-degree-C or more range of 120 degrees C or less, The exposure process which exposes said sensitive-material film using the predetermined photo mask corresponding to the configuration of the light filter to form, The manufacture approach of the light filter characterized by what the development process which develops said exposed sensitive-material film, and the process which carries out postbake of said developed sensitive-material film are provided, and the light filter which has a taper is formed in an edge for.
[Claim 5] Claim 1 characterized by what a transparent electrode is formed on each aforementioned light filter, the orientation film for carrying out orientation of the liquid crystal is formed on this transparent electrode, and orientation processing is performed for to the front face of this orientation film thru/or the manufacture approach of the light filter any one publication of four.
[Claim 6] The process which forms the sensitive-material film for light filter formation, and the process which prebakes said sensitive-material film, The exposure process which exposes said sensitive-material film using the predetermined photo mask corresponding to the configuration of the light filter to form, It controls to raise baking temperature as the include angle theta of the taper formed in the edge of the light filter to form becomes large. The 1st postbake process which bakes said sensitive-material film [finishing / exposure], The development process which forms the light filter which developed said sensitive-material film by which postbake was carried out, and was equipped with the taper corresponding to the baking temperature of said 1st postbake process, The manufacture approach of the light filter characterized by providing the 2nd postbake process which bakes the formed light filter, and forming in an edge the light filter which has a taper.
[Claim 7] The process which forms the sensitive-material film for light filter formation in order to form in an edge the light filter which has a taper, It controls to raise baking temperature as the include angle theta of the taper formed in the edge of the light filter to form becomes large. The process which prebakes said sensitive-material film, and the exposure process which exposes said sensitive-material film using the predetermined photo mask corresponding to the configuration of the light filter to form, The manufacture approach of the light filter characterized by providing the development process which forms the light filter which develops said exposed sensitive-material film and has a taper corresponding to the temperature of said prebaking, and the process which carries out postbake of the light filter formed of development.
[Claim 8] The light filter with which the taper which inclines at the include angle which has been arranged so that an edge may lap with a black

mask and said black mask, and was decided to be an edge according to thickness was formed, The substrate which is one side equipped with the transparent electrode arranged on said light filter, and the orientation film with which it was formed on said transparent electrode, and orientation processing was performed to the front face, The electrochromatic display display device characterized by having the liquid crystal which countered one [said] substrate, has been arranged and has been arranged between the substrate of another side equipped with an electrode and the orientation film, one [said] substrate, and the substrate of another side.

[Detailed Description of the Invention]
[0001]
[Industrial Application] Especially this invention relates to the manufacture approach of a light filter and electrochromatic display display device which have a taper at the edge about the manufacture approach of a light filter, and an electrochromatic display display device.
[0002]
[Description of the Prior Art] The substrate 81 whose conventional liquid crystal display component is one side which carried out sequential formation of the passivation film 82, the black mask 83, the light filter 84 of RGB each color, a transparent electrode 85, and the orientation film 86 as shown in drawing 8 , It is formed by arranging the substrate 91 of another side which carried out sequential formation of the passivation film 92, a transparent electrode 93, a protective coat 94, and the orientation film 95 face to face through sealant SC, and arranging liquid crystal 96 among both the substrates 81 and 91.
[0003]
[Problem(s) to be Solved by the Invention] the substrate 81 top with which a light filter 84 contains the passivation film 82 -- the color resist film (film) -- forming -- this -- photograph RISOGURAFU -- negatives are exposed and developed by law and it is formed. That is, the light filter 84 is formed by etching and carrying out patterning of the film exposed by the FOTORISO graphic method. Thus, the edge section of each formed light filter 84 became Sharp naturally, as shown in drawing 8 , and the clear level difference has produced it between the parts which are not used as the part in which a light filter 84 exists.
[0004] When ITO is deposited by sputtering, the ion plating method, etc. and a transparent electrode 85 is formed on such a light filter 84, while the transparent electrode 85 on the edge of a light filter 84 becomes thin, shearing force is added, and an open circuit may occur or it may become high resistance. For this reason, a loss may arise on the electrical potential difference effectually impressed to liquid crystal 96, threshold voltage may vary, and display quality may deteriorate.
[0005] Moreover, the hollow according to the level difference of a light filter 84 is generated on the front face of the orientation film 86, in case it is rubbing processing, contact of the rubbing cloth to the hollow section becomes weak, and a rubbing consistency becomes low. Consequently, the pre tilt angle of the liquid crystal molecule near the hollow section of a light filter 84 becomes large, it may be easy to generate a reverse tilt domain (minute field where the tilt angle of a liquid crystal molecule differs from other fields), poor orientation may be generated, and display quality may deteriorate.
[0006] This invention was made in view of the above-mentioned actual condition, and aims at offering the manufacture approach of the electrochromatic display display device which can display a high-definition image, and a light filter. Moreover, this invention sets it as other objects to offer the liquid crystal display component which is [open circuit / an electrode] hard to generate.
[0007]
[Means for Solving the Problem] In order to attain the above-mentioned object, the manufacture approach of the 1st light filter this invention The process which forms the sensitive-material film for light filter formation, and the process which prebakes said sensitive-material film, At the exposure process which exposes said sensitive-material film using the predetermined photo mask corresponding to the configuration of the light filter to form, and the temperature according to the include angle of the taper formed in the edge of the light filter to form The 1st postbake process which bakes said exposed sensitive-material film, The development process which develops said sensitive-material film by which postbake was carried out, and the 2nd postbake process which carries out postbake of said developed sensitive-material film are provided, and it is characterized by what the light filter which has a taper is formed in an edge for.
[0008] The manufacture approach of the 2nd light filter this invention The process prebaked according to the include angle of the process which forms the sensitive-material film for light filter formation, and the taper which forms said sensitive-material film in the edge of the light filter to form at the temperature of the 60-degree-C or more range of 120 degrees C or less, The exposure process which exposes said sensitive-material film using the predetermined photo mask corresponding to the configuration of

the light filter to form, The development process which develops said exposed sensitive-material film, and the process which carries out postbake of said developed sensitive-material film are provided, and it is characterized by what the light filter which has a taper is formed in an edge for.

[0009] Moreover, the electrochromatic display display device concerning this invention The light filter with which the taper which inclines at the include angle which has been arranged so that an edge may lap with a black mask and said black mask, and was decided to be an edge according to thickness was formed, The substrate which is one side equipped with the transparent electrode arranged on said light filter, and the orientation film with which it was formed on said transparent electrode, and orientation processing was performed to the front face, It is characterized by having the liquid crystal which countered one [said] substrate, has been arranged and has been arranged between the substrate of another side equipped with an electrode and the orientation film, one [said] substrate, and the substrate of another side.

[0010]

[Function] baking in the manufacture approach of the light filter concerning the 1st and 2nd viewpoints of this invention, before developing negatives after exposure -- or a taper can be formed in the edge of a light filter by prebaking at 60 degrees C thru/or 120 degrees C. Furthermore, the include angle of a taper becomes large with lifting of baking temperature. Therefore, the light filter which has the taper of a desired angle of inclination can be formed by controlling baking temperature.

[0011] Moreover, in the liquid crystal display component concerning this invention, since the taper is formed in the edge of a light filter, it is rare for a transparent electrode to become thin or to cut. Moreover, since the taper was formed in the edge of a light filter, the irregularity of the front face of the orientation film becomes quiet, and the consistency of orientation processings, such as rubbing given to the front face, serves as homogeneity mostly. Therefore, the liquid crystal display component which can display the image of high quality with few defects, such as display nonuniformity, can be offered.

[0012]

[Example] Hereafter, the manufacture approach of a light filter and electrochromatic display display device concerning the example of this invention are explained with reference to a drawing.

[0013] (The 1st example) The manufacture approach of of the electrochromatic display display device and light filter which are applied to the 1st example of this invention with reference to drawing 1 - drawing 3 is explained first. The electrochromatic display display device of this example has the liquid crystal cell in which while was formed in, and the passivation film 12, the black mask 13, the light filter 14 (14R, 14G, 14B) of RGB each color, a transparent electrode 15, and the orientation film 16 joined the substrate 11 and the substrate 21 of another side in which the passivation film 22, a transparent electrode 23, a protective coat 24, and the orientation film 25 were formed through sealant SC, and were formed, as shown in drawing 1 . This liquid crystal cell is filled up with liquid crystal 26, and polarizing plates 27 and 28 are arranged on both sides of the liquid crystal cell.

[0014] The light filter 14 is formed the shape of a stripe, and in the shape of a mosaic, and the taper (ramp) is formed in the edge so that it may be a cross section and may illustrate at a flat surface to drawing 1 at drawing 2 . the ratio (Y-Z) to die-length X of the taper of the difference (Y-Z) of height Y of the light filter 14 shown in drawing 3 , and height Z of a black mask -- if /X=tantheta is too large -- a transparent electrode 15 -- an open circuit etc. -- being generated -- being easy -- and irregularity forms in the front face of the orientation film 16 -- having -- being easy -- when too small, it becomes impossible to secure the effectual thickness in each pixel field Moreover, if a light filter 14 is thick, the hollow produced on the front face of the orientation film 16 will become deep, and it will become easy to produce poor orientation. Moreover, as for a taper, it is desirable to be formed so that it may fit in the field which overlaps the black mask 13. Therefore, optimal tantheta changes for every thickness of a light filter 14. So, in this example, tantheta of the include angle theta of a taper is set up as follows according to the thickness of a light filter 14.

[0015]

[A table 1]

Thickness of a light filter tantheta 1.0 micrometers or more less than 1.2 micrometers 0.08-0.10 1.2 micrometers or more less than 1.4 micrometers 0.11-0.125 1.4 micrometers or more less than 1.6 micrometers 0.13-0.16 1.6 micrometers or more less than 1.8 micrometers 0.18-0.20 1.8 micrometers or more 0.21-0.30

[0016] A transparent electrode 15 is formed from ITO with a thickness of about 20-200nm, and is directly formed on the light filter 14. It is prevented that this transparent electrode 15 does not become thin in the edge section of a light filter 14, and resistance becomes large locally or disconnects it since the taper is formed in the light filter 14.

[0017] The orientation film 16 consists of polyimide etc. and orientation processing of

rubbing etc. is performed to the front face. In the front face of the orientation film 16, the irregularity corresponding to the configuration of a light filter 14 has arisen. However, since the taper is formed in the edge of a light filter 14, the front face of the orientation film 16 is comparatively smooth, and the reinforcement of rubbing also serves as homogeneity mostly. Therefore, it becomes uniform at about 1 appearance, a reverse tilt domain (minute field where the tilt angle of a liquid crystal molecule differs from other fields) does not occur, and display nonuniformity does not generate the pre tilt angle of the molecule of the about 16 orientation film liquid crystal 26.

[0018] Next, the manufacture approach of the liquid crystal display component shown in drawing 1 is explained with reference to drawing 4 and drawing 5 .

[0019] First, the passivation film 12 which consists of SiO2, SiN, etc. is formed with a CVD method etc. on the substrate 11 which consists of glass etc. Then, about 0.2-0.3 micrometers of metals, such as chromium, are deposited on the passivation film 12, patterning of this is carried out, and the black mask 13 with a width of face of about 15-25 micrometers is formed.

[0020] Next, a substrate 11 is washed (drawing 4 , step S1). Then, in order to form light filter 14of R (red) R, as shown in drawing 5 (A), the color resist (photopolymerization ingredient) containing the pigment of R etc. is applied with a spin coat method etc. on a substrate 11, for example, the color resist film 31 with a thickness of 1.1 micrometers - about 1.8 micrometers is formed (step S2). In addition, according to the amount of the pigment to contain, the thickness of the color resist film 31 is adjusted so that a suitable color tone may be acquired.

[0021] The applied color resist film 31 is prebaked about 2 to 3 minutes at 60 degrees C - 120 degrees C (step S3). In addition, supposing it makes prebaking temperature into 50 degrees C or less, there is a possibility that development may not be performed normally. Then, as shown in drawing 5 (B), the color resist film 31 is exposed with UV light of 100 mJ/cm2 (wavelength of 365nm) using the photo mask 33 with which the pattern of the shape of the shape of a stripe corresponding to the configuration of the light filter of R and a matrix was formed (step S4).

[0022] Usually, in this example, although the color resist film 31 after exposure is developed, in order to form the taper of the desired include angle theta in the edge of each color light filter 14, the 1st postbake (taper processing) is performed (step S5). The degree of adhesion of the color resist film 31 and the passivation film 12 improves, and that degree of adhesion changes with these baking according to baking temperature. For this reason, as shown in drawing 6 , the include angle theta of the taper formed in the edge of the light filter 14 after development changes with baking temperature. Moreover, according to the thickness of a light filter 14, the optimum value of the include angle theta of a taper changes as mentioned above. Then, according to the thickness of the light filter 14 to form, baking temperature is adjusted so that the optimal include angle theta may be obtained. For example, when thickness of light filter 14R of R is set to 1.1 micrometers, the optimum values of tantheta are 0.08-0.10. Then, it bakes about 2 to 3 minutes at about 105 degrees C - about 110 degrees C from drawing 6 .

[0023] Then, the color resist film 31 is developed using a developer at about **1 degree C with a temperature of 30 degrees C, and as shown in drawing 5 (C), light filter 14of R R is formed (step S6). Since the 1st postbake is carried out, the taper which has the optimal include angle theta according to baking temperature is formed in the edge of light filter 14R.

[0024] Then, a rinse (back washing) is performed (step S7), after that, the 230 degrees C of the 2nd postbake for about 15 minutes are performed (step S8), and light filter 14of R R is completed.

[0025] Next, in order to form light filter 14G of G, the color resist film containing the pigment of G is formed and (step S2) prebaked after washing (step S1) (step S3). The 1st postbake is performed, in order to expose the prebaked color resist film for G with UV light of 150 mJ/cm2 (wavelength of 365nm) (step S4) and to form a taper in the edge of light filter 14G (step S5). When the thickness of the light filter of G is assumed to be 1.3 micrometers, the optimum values of tantheta are 0.11-0.125. Then, it bakes for 2 - 3 minutes at about about 80-120 degrees C from drawing 6 .

[0026] Then, the color resist film for G is developed (step S6), and as shown in drawing 5 (D), light filter 14G of G are formed. At this time, the taper of an include angle according to the baking temperature of the 1st postbake is formed. After a rinse (step S7), 230 degrees C of postbake processings for about 15 minutes are performed (step S8), and the light filter of G is completed.

[0027] Next, in order to form light filter 14of B B, the color resist film containing the color of B etc. is formed and (step S2) prebaked after washing (step S1) (step S3). Then, the color resist film for B is exposed with UV light of 100 mJ/cm2 (wavelength of 365nm) using a photo mask (step S4), and the 1st postbake is performed (step S5). For example, when thickness of the light filter of B is set to 1.5 micrometers, the optimum values of tantheta are 0.13-0.16. Then, it bakes at about about 80-95

degrees C from drawing 6 .

[0028] Then, the color resist film for B is developed and light filter 14of B B is formed (step S6). At this time, the taper of an include angle according to postbake temperature is formed. After a rinse (step S7), 230 degrees C of postbakes for about 15 minutes are performed (step S8), and light filter 14of B B is completed.

[0029] Then, ITO with a thickness of about 20-200nm is formed by the sputtering method or the ion plating method on each light filter 14, patterning of this is carried out and a transparent electrode 15 is formed. Since a taper is formed in the edge of each light filter 14, the ITO film can prevent the situation which becomes thin in the edge section of a light filter in the case of formation of an electrode 15. Moreover, the situation where shearing force is added and is cut by the ITO film can be prevented.

[0030] The polyimide film is formed on a transparent electrode 15, and rubbing of this front face is carried out using a rubbing drum etc. Since the taper is formed in the edge of a light filter 14, the irregularity of orientation film 16 front face is quiet, a rubbing cloth contacts homogeneity mostly on the front face of the orientation film 16, and a rubbing consistency becomes homogeneity mostly.

[0031] Next, the substrate 21 in which the passivation film 22, a transparent electrode 23, a protective coat 24, and the orientation film 25 were formed is joined through sealant SC, liquid crystal 26 is poured in, and a liquid crystal cell is formed. The liquid crystal display component shown in drawing 1 is completed by [of a liquid crystal cell] arranging polarizing plates 27 and 28 up and down.

[0032] (The 2nd example) In the 1st example, the include angle of the taper formed in the edge of a light filter was adjusted by adjusting the baking temperature of the 1st postbake processing. However, it is also possible by adjusting the temperature of the prebaking processing before exposure (step S3) to adjust the include angle theta of a taper. In this case, 1st postbake processing is not performed. Drawing 7 shows prebaking temperature in case the thickness of a light filter is 1.1**0.3 micrometers, and the relation of tantheta. tantheta becomes large as are shown in drawing 7 and baking temperature rises. Moreover, the property shown in drawing 7 moves up as the thickness of a light filter becomes thick. Therefore, according to the thickness of a light filter, prebaking temperature can be adjusted and desired tantheta can be obtained.

[0033] In addition, tantheta may be adjusted by adjusting both prebaking temperature and the baking temperature of the 1st postbake.

[0034] This invention is not limited to the above-mentioned example, but various deformation application is possible for it. For example, the sequence of formation is arbitrary although the light filter 14 was formed in order of R->G->B. Moreover, although the light filter 14 was formed on the substrate 11 containing the passivation film 12 in the above-mentioned example, a light filter 14 may be directly formed on a substrate 11, for example. Moreover, a transparent electrode 15 may be formed on a substrate 11, and a light filter 14 may be formed on it. Moreover, although the light filter was formed by carrying out patterning of the color resist in the above-mentioned example, the light filter which has a taper may be formed by carrying out patterning of the colorless photoresist to the configuration which has a taper, and dyeing this.

[0035] Although the passive-matrix type thing of a transparency mold was illustrated in the above-mentioned example as a liquid crystal display component which used the light filter, the light filter of this invention is applicable also like a reflective mold or active-matrix type liquid crystal display component.

[0036]

[Effect of the Invention] Since according to this invention a taper is formed in the edge of a light filter and a cone angle can be adjusted as explained above, cutting of a transparent electrode which carries out a laminating on a light filter cannot take place easily, the irregularity of the front face of the orientation film becomes quiet, the reinforcement of rubbing given to that front face becomes almost uniform, and a liquid crystal display component with few display defects, such as nonuniformity, can be offered.

[Brief Description of the Drawings]

[Drawing 1] It is the sectional view showing the structure of the electrochromatic display display device concerning the 1st example of this invention.

[Drawing 2] It is the top view of the light filter for 1 pixel.

[Drawing 3] It is the enlarged drawing of the cross section of a light filter.

[Drawing 4] It is the flow chart which shows the production process of the light filter shown in drawing 1 .

[Drawing 5] (A) - (D) is the sectional view showing the production process of the light filter shown in drawing 1 .

[Drawing 6] It is the graph which shows the relation between the baking temperature of the 1st postbake, and the include angle of a taper according to the thickness of a light filter.

[Drawing 7] It is the graph which shows the

relation between the baking temperature of prebaking, and a cone angle.

[Drawing 8] It is the sectional view showing the cross-section structure of the conventional light filter.

[Description of Notations]

11 ... a substrate and 12 ... the passivation film and 13 ... a black mask and 14 ... a light filter and 15 ... a transparent electrode (ITO) and 16 ... the orientation film and 21 ... a substrate and 22 ... the passivation film and 23 ... a transparent electrode and 24 ... a protective coat and 25 ... the orientation film and 26 ... liquid crystal and 27 ... a polarizing plate and 28 -- ... -- a polarizing plate and 31 -- ... the color resist film and 33 -- ... a photo mask and SC -- ... a sealant

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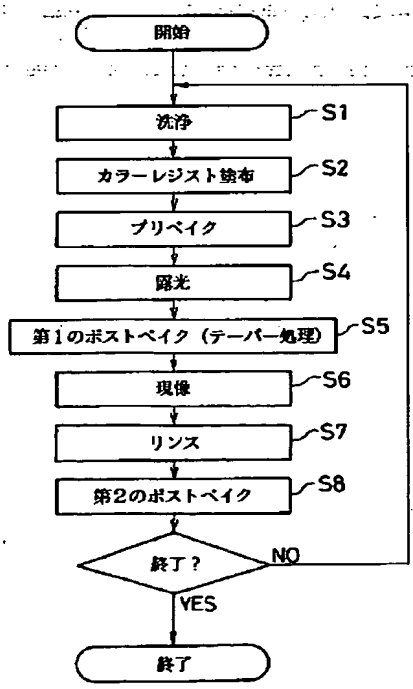
(54)【発明の名称】　カラーフィルタの製造方法とカラー液晶表示素子

(57)【要約】

【目的】　高品位の画像を表示することが可能な液晶表示素子用カラーフィルタの製造方法を提供することである。

【構成】　カラーレジスト膜を形成し（Ｓ２）、カラーレジスト膜をプリベイクし（Ｓ３）、続いて、フォトマスクを用いて露光する（Ｓ４）。露光後、第１のポストベイクを行い（Ｓ５）、続いて、現像してカラーフィルタを形成する（Ｓ６）。形成されたカラーフィルタをベイクして（Ｓ８）、カラーフィルタを完成する。この処理をカラーフィルタの色毎に繰り返し、ＲＧＢ３色のカラーフィルタを形成する。プリベイクのベイク温度と第１のポストベイクのベイク温度を制御することにより、カラーフィルタの端部に形成するテーパーの角度を制御し、カラーフィルタの厚さに最適なテーパー角度を設定する。



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【特許請求の範囲】

【請求項１】カラーフィルタ形成用の感光材料膜を形成する工程と、

前記感光材料膜をプリベイクする工程と、

形成するカラーフィルタの形状に対応する所定のフォトマスクを用いて前記感光材料膜を露光する露光工程と、

形成するカラーフィルタの端部に形成するテーパーの角度に応じた温度で、露光された前記感光材料膜をベイクする第１のポストベイク工程と、

ポストベイクされた前記感光材料膜を現像する現像工程と、

現像された前記感光材料膜をポストベイクする第２のポストベイク工程と、

を具備し、端部にテーパーを有するカラーフィルタを形成する、ことを特徴とするカラーフィルタの製造方法。

【請求項２】前記第１のポストベイク工程におけるベイク温度は前記プリベイク工程におけるベイク温度よりも高い、ことを特徴とする請求項１に記載のカラーフィルタの製造方法。

【請求項３】各前記カラーフィルタのテーパーの角度θのｔａｎθは、カラーフィルタの厚さが、１．０μｍ以上１．２μｍ未満、１．２μｍ以上１．４μｍ未満、１．４μｍ以上１．６μｍ未満、１．６μｍ以上１．８μｍ未満、１．８μｍ以上のとき、それぞれ、０．０８以上０．１０以下、０．１１以上０．１２５以下、０．１３以上０．１６以下、０．１８以上０．２０以下、０．２１以上０．３０以下である、ことを特徴とする請求項１又は２に記載のカラーフィルタの製造方法。

【請求項４】カラーフィルタ形成用の感光材料膜を形成する工程と、

前記感光材料膜を、形成するカラーフィルタの端部に形成するテーパーの角度に応じて、６０℃以上１２０℃以下の範囲の温度でプリベイクする工程と、

形成するカラーフィルタの形状に対応する所定のフォトマスクを用いて前記感光材料膜を露光する露光工程と、

露光された前記感光材料膜を現像する現像工程と、

現像された前記感光材料膜をポストベイクする工程と、

を具備し、端部にテーパーを有するカラーフィルタを形成する、ことを特徴とするカラーフィルタの製造方法。

【請求項５】各前記カラーフィルタの上に透明電極を形成し、

該透明電極の上に液晶を配向させるための配向膜を形成し、該配向膜の表面に配向処理を施す、ことを特徴とする請求項１乃至４のいずれか１つに記載のカラーフィルタの製造方法。

【請求項６】カラーフィルタ形成用の感光材料膜を形成する工程と、

前記感光材料膜をプリベイクする工程と、

形成するカラーフィルタの形状に対応する所定のフォトマスクを用いて前記感光材料膜を露光する露光工程と、

2

形成するカラーフィルタの端部に形成するテーパーの角度θが大きくなるに従ってベイク温度を上昇させるように制御して、露光済みの前記感光材料膜をベイクする第１のポストベイク工程と、

ポストベイクされた前記感光材料膜を現像して、前記第１のポストベイク工程のベイク温度に対応するテーパーを備えたカラーフィルタを形成する現像工程と、

形成されたカラーフィルタをベイクする第２のポストベイク工程と、

を具備し、端部にテーパーを有するカラーフィルタを形成することを特徴とするカラーフィルタの製造方法。

【請求項７】端部にテーパーを有するカラーフィルタを形成するために、カラーフィルタ形成用の感光材料膜を形成する工程と、

形成するカラーフィルタの端部に形成するテーパーの角度θが大きくなるに従ってベイク温度を上昇させるように制御して、前記感光材料膜をプリベイクする工程と、

形成するカラーフィルタの形状に対応する所定のフォトマスクを用いて前記感光材料膜を露光する露光工程と、

露光された前記感光材料膜を現像し、前記プリベイクの温度に対応するテーパーを有するカラーフィルタを形成する現像工程と、

現像により形成されたカラーフィルタをポストベイクする工程と、

を具備することを特徴とするカラーフィルタの製造方法。

【請求項８】ブラックマスクと、前記ブラックマスクに端部が重なるように配置され、端部に厚みに応じて決められた角度で傾斜するテーパーが形成されたカラーフィルタと、前記カラーフィルタ上に配置された透明電極と、前記透明電極上に形成され、表面に配向処理が施された配向膜とを備えた一方の基板と、

前記一方の基板に対向して配置され、電極と配向膜とを備えた他方の基板と、

前記一方の基板と他方の基板の間に配置された液晶と、

を備えることを特徴とするカラー液晶表示素子。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】この発明は、カラーフィルタの製造方法とカラー液晶表示素子に関し、特に、端部にテーパーを有するカラーフィルタの製造方法とカラー液晶表示素子に関する。

【０００２】

【従来の技術】従来の液晶表示素子は、図８に示すように、パッシベーション膜８２、ブラックマスク８３、ＲＧＢ各色のカラーフィルタ８４、透明電極８５、配向膜８６を順次形成した一方の基板８１と、パッシベーション膜９２、透明電極９３、保護膜９４、配向膜９５を順次形成した他方の基板９１とをシール材ＳＣを介して対向して配置し、両基板８１、９１の間に液晶９６を配置

することにより形成されている。

【０００３】

【発明が解決しようとする課題】カラーフィルタ８４は、パッシベーション膜８２を含む基板８１上にカラーレジスト膜（感光膜）を形成し、これをフォトリソグラフ法により露光・現像して形成されている。即ち、カラーフィルタ８４はフォトリソグラフ法により露光された感光膜をエッチングしてパターニングすることにより形成されている。この様にして形成された各カラーフィルタ８４のエッジ部は、図８に示すように自ずとシャープになり、カラーフィルタ８４が存在する部分としない部分との間に明確な段差が生じている。

【０００４】このようなカラーフィルタ８４の上にＩＴＯをスパッタリング、イオンプレーティング法等により堆積して透明電極８５を形成した場合、カラーフィルタ８４のエッジ上の透明電極８５が薄くなると共に剪断力が加わり、断線が発生したり、高抵抗となる場合がある。このために、液晶９６に実効的に印加される電圧にロスが生じ、閾値電圧がばらついて表示品質が低下する場合がある。

【０００５】また、配向膜８６の表面にカラーフィルタ８４の段差に応じた窪みが生じ、ラビング処理の際に、窪み部へのラビング布の接触が弱くなり、ラビング密度が低くなる。その結果、カラーフィルタ８４の窪み部近傍の液晶分子のプレチルト角が大きくなり、リバースチルトドメイン（液晶分子のチルト角が他の領域とは異なる微小領域）が発生し易く、配向不良が生じ、表示品質が低下する場合がある。

【０００６】この発明は、上記実状に鑑みてなされたもので、高品位の画像を表示することが可能なカラー液晶表示素子及びカラーフィルタの製造方法を提供することを目的とする。また、この発明は、電極の断線等の発生しにくい液晶表示素子を提供することを他の目的とする。

【０００７】

【課題を解決するための手段】上記目的を達成するため、この発明の第１のカラーフィルタの製造方法は、カラーフィルタ形成用の感光材料膜を形成する工程と、前記感光材料膜をプリベイクする工程と、形成するカラーフィルタの形状に対応する所定のフォトマスクを用いて前記感光材料膜を露光する露光工程と、形成するカラーフィルタの端部に形成するテーパーの角度に応じた温度で、露光された前記感光材料膜をベイクする第１のポストベイク工程と、ポストベイクされた前記感光材料膜を現像する現像工程と、現像された前記感光材料膜をポストベイクする第２のポストベイク工程と、を具備し、端部にテーパーを有するカラーフィルタを形成する、ことを特徴とする。

【０００８】この発明の第２のカラーフィルタの製造方法は、カラーフィルタ形成用の感光材料膜を形成する工

程と、前記感光材料膜を、形成するカラーフィルタの端部に形成するテーパーの角度に応じて、６０℃以上１２０℃以下の範囲の温度でプリベイクする工程と、形成するカラーフィルタの形状に対応する所定のフォトマスクを用いて前記感光材料膜を露光する露光工程と、露光された前記感光材料膜を現像する現像工程と、現像された前記感光材料膜をポストベイクする工程と、を具備し、端部にテーパーを有するカラーフィルタを形成する、ことを特徴とする。

【０００９】また、この発明にかかるカラー液晶表示素子は、ブラックマスクと、前記ブラックマスクに端部が重なるように配置され、端部に厚みに応じて決められた角度で傾斜するテーパーが形成されたカラーフィルタと、前記カラーフィルタ上に配置された透明電極と、前記透明電極上に形成され、表面に配向処理が施された配向膜とを備えた一方の基板と、前記一方の基板に対向して配置され、電極と配向膜とを備えた他方の基板と、前記一方の基板と他方の基板の間に配置された液晶と、を備えることを特徴とする。

【００１０】

【作用】この発明の第１及び第２の観点に係るカラーフィルタの製造方法において、露光後現像する前にベイクを行うことにより、或いは、プリベイクを６０℃乃至１２０℃で行うことにより、カラーフィルタの端部にテーパーを形成することができる。さらに、ベイク温度の上昇に伴ってテーパーの角度が大きくなる。従って、ベイク温度を制御することにより、所望の傾き角のテーパーを有するカラーフィルタを形成することができる。

【００１１】また、この発明に係る液晶表示素子においては、カラーフィルタの端部にテーパーが形成されているので、透明電極が薄くなったり、切断したりすることが少ない。また、カラーフィルタの端部にテーパーを形成したので、配向膜の表面の凹凸が穏やかになり、その表面に施すラビング等の配向処理の密度がほぼ均一となる。従って、表示ムラ等の欠陥の少ない高品質の画像を表示できる液晶表示素子を提供することができる。

【００１２】

【実施例】以下、この発明の実施例にかかるカラーフィルタの製造方法とカラー液晶表示素子を図面を参照して説明する。

【００１３】（第１実施例）まず、図１～図３を参照してこの発明の第１実施例にかかるカラー液晶表示素子及びカラーフィルタの製造方法を説明する。この実施例のカラー液晶表示素子は、図１に示すように、パッシベーション膜１２、ブラックマスク１３、ＲＧＢ各色のカラーフィルタ１４（１４Ｒ，１４Ｇ，１４Ｂ）、透明電極１５、配向膜１６が形成された一方の基板１１と、パッシベーション膜２２、透明電極２３、保護膜２４、配向膜２５が形成された他方の基板２１とをシール材ＳＣを介して接合して形成された液晶セルを有する。この液晶

5

セルには液晶２６が充填され、液晶セルを挟んで偏光板２７、２８が配置されている。

【００１４】カラーフィルタ１４は、ストライプ状又はモザイク状に形成されており、図１に断面で、図２に平面で例示するように、端部にテーパー（傾斜部）が形成されている。図３に示すカラーフィルタ１４の高さＹとブラックマスクの高さＺとの差（Ｙ－Ｚ）のテーパーの長さＸに対する比（Ｙ－Ｚ）／Ｘ＝ｔａｎθは、大きすぎると透明電極１５に断線等が生じ易くなり且つ配向膜１６の表面に凹凸が形成され易くなり、小さすぎると各画素領域での実効的な厚みが確保できなくなる。また、＊

6

＊カラーフィルタ１４が厚いと、配向膜１６の表面に生じる窪みが深くなり、配向不良が生じ易くなる。また、テーパーはブラックマスク１３とオーバーラップする領域に収まるように形成されるのが望ましい。従って、カラーフィルタ１４の厚さ毎に最適なｔａｎθが変化する。そこで、この実施例では、テーパーの角度θのｔａｎθはカラーフィルタ１４の膜厚に応じて次のように設定されている。

【００１５】

【表１】

カラーフィルタの厚さ	ｔａｎθ
１．０μｍ以上１．２μｍ未満	０．０８～０．１０
１．２μｍ以上１．４μｍ未満	０．１１～０．１２５
１．４μｍ以上１．６μｍ未満	０．１３～０．１６
１．６μｍ以上１．８μｍ未満	０．１８～０．２０
１．８μｍ以上	０．２１～０．３０

【００１６】透明電極１５は、厚さ２０～２００ｎｍ程度のＩＴＯから形成され、カラーフィルタ１４の上に直接形成されている。この透明電極１５は、カラーフィルタ１４にテーパーが形成されているので、カラーフィルタ１４のエッジ部で薄くなることが無く、抵抗が局部的に大きくなったり断線することが防止されている。

【００１７】配向膜１６は、ポリイミド等から構成され、その表面には、ラビング等の配向処理が施されている。配向膜１６の表面には、カラーフィルタ１４の形状に対応した凹凸が生じている。しかし、カラーフィルタ１４の端部にテーパーが形成されているので、配向膜１６の表面は比較的滑らかであり、ラビングの強度もほぼ均一となる。従って、配向膜１６近傍の液晶２６の分子のプレチルト角はほぼ一様に均一となり、リバースティルトドメイン（液晶分子のチルト角が他の領域とは異なる微小領域）が発生せず、表示ムラが発生しない。

【００１８】次に、図１に示す液晶表示素子の製造方法を図４及び図５を参照して説明する。

【００１９】まず、ガラス等からなる基板１１上にＳｉO_2、ＳｉＮ等からなるパッシベーション膜１２をＣＶＤ法等により形成する。続いて、パッシベーション膜１２上にクロム等の金属を０．２～０．３μｍ程度堆積し、これをパターニングして１５～２５μｍ程度の幅のブラックマスク１３を形成する。

【００２０】次に、基板１１を洗浄する（図４、ステップＳ１）。続いて、Ｒ（赤）のカラーフィルタ１４Ｒを形成するため、図５（Ａ）に示すように、基板１１上にＲの顔料等を含むカラーレジスト（光重合材料）をスピンコート法等により塗布し、例えば、１．１μｍ～１．８μｍ程度の厚さのカラーレジスト膜３１を形成する（ステップＳ２）。なお、カラーレジスト膜３１の厚さは、含有する顔料等の量に応じて、適切な色調が得られるように調整する。

【００２１】塗布されたカラーレジスト膜３１を６０℃～１２０℃で２～３分程度プリベイクする（ステップＳ３）。なお、プリベイク温度を５０℃以下とするとすると、現像が正常に行われない虞がある。続いて、図５（Ｂ）に示すように、Ｒのカラーフィルタの形状に対応したストライプ状又はマトリクス状のパターンが形成されたフォトマスク３３を用いてカラーレジスト膜３１を１００ｍＪ／ｃｍ^2（波長３６５ｎｍ）のＵＶ光で露光する（ステップＳ４）。

【００２２】通常は、露光後カラーレジスト膜３１を現像するが、この実施例では、各色カラーフィルタ１４の端部に所望の角度θのテーパーを形成するため、第１のポストベイク（テーパー処理）を行う（ステップＳ５）。このベイクにより、カラーレジスト膜３１とパッシベーション膜１２との密着度が向上し、その密着度がベイク温度に応じて変化する。このため、図６に示すように、現像後カラーフィルタ１４の端部に形成されるテーパーの角度θがベイク温度により変化する。また、前述のように、カラーフィルタ１４の厚さに応じてテーパーの角度θの最適値が変化する。そこで、形成するカラーフィルタ１４の厚さに応じて、最適な角度θが得られるようにベイク温度を調整する。例えば、Ｒのカラーフィルタ１４Ｒの厚さを１．１μｍとすると、ｔａｎθの最適値は０．０８～０．１０である。そこで、図６よりほぼ１０５℃～１１０℃程度で２～３分程度ベイクする。

【００２３】続いて、現像液を用いて温度３０℃±１℃程度でカラーレジスト膜３１を現像し、図５（Ｃ）に示すように、Ｒのカラーフィルタ１４Ｒを形成する（ステップＳ６）。第１のポストベイクが実施されているため、カラーフィルタ１４Ｒの端部には、ベイク温度に応じて最適な角度θを有するテーパーが形成される。

【００２４】続いて、リンス（後洗浄）を行い（ステッ

プＳ７）、その後、２３０℃１５分程度の第２のポストベイクを行い（ステップＳ８）、Ｒのカラーフィルタ１４Ｒを完成する。

【００２５】次に、Ｇのカラーフィルタ１４Ｇを形成するため、洗浄（ステップＳ１）後、Ｇの顔料を含むカラーレジスト膜を形成し（ステップＳ２）、プリベイクする（ステップＳ３）。プリベイクされたＧ用カラーレジスト膜を１５０ｍＪ／ｃｍ^2（波長３６５ｎｍ）のＵＶ光で露光し（ステップＳ４）、カラーフィルタ１４Ｇの端部にテーパーを形成するため、第１のポストベイクを行う（ステップＳ５）。Ｇのカラーフィルタの厚さを１．３μｍと仮定すると、ｔａｎθの最適値は０．１１～０．１２５である。そこで、図６より、ほぼ８０～１２０℃程度で２～３分間ベイクする。

【００２６】続いて、Ｇ用カラーレジスト膜を現像し（ステップＳ６）、図５（Ｄ）に示すように、Ｇのカラーフィルタ１４Ｇを形成する。このとき、第１のポストベイクのベイク温度に応じた角度のテーパーが形成される。リンス（ステップＳ７）後、２３０℃１５分程度のポストベイク処理を行い（ステップＳ８）、Ｇのカラーフィルタを完成する。

【００２７】次に、Ｂのカラーフィルタ１４Ｂを形成するため、洗浄（ステップＳ１）後、Ｂの染料等を含むカラーレジスト膜を形成し（ステップＳ２）、プリベイクする（ステップＳ３）。続いて、フォトマスクを用いてＢ用カラーレジスト膜を１００ｍＪ／ｃｍ^2（波長３６５ｎｍ）のＵＶ光で露光し（ステップＳ４）、第１のポストベイクを行う（ステップＳ５）。例えば、Ｂのカラーフィルタの厚さを１．５μｍとすると、ｔａｎθの最適値は０．１３～０．１６である。そこで、図６より、ほぼ８０～９５℃程度でベイクする。

【００２８】続いて、Ｂ用カラーレジスト膜を現像し、Ｂのカラーフィルタ１４Ｂを形成する（ステップＳ６）。このとき、ポストベイク温度に応じた角度のテーパーが形成される。リンス（ステップＳ７）後、２３０℃１５分程度のポストベイクを行い（ステップＳ８）、Ｂのカラーフィルタ１４Ｂを完成する。

【００２９】続いて、各カラーフィルタ１４の上に２０～２００ｎｍ程度の厚さのＩＴＯをスパッタリング法あるいはイオンプレーティング法等により形成し、これをパターニングして透明電極１５を形成する。各カラーフィルタ１４の端部にテーパーが形成されるので、電極１５の形成の際に、ＩＴＯ膜がカラーフィルタのエッジ部で薄くなる事態を防止できる。また、ＩＴＯ膜にせん断力が加わって切断される事態を防止できる。

【００３０】透明電極１５の上にポリイミド膜を形成し、この表面をラビングドラム等を用いてラビングする。カラーフィルタ１４の端部にテーパーが形成されているので、配向膜１６表面の凹凸が穏やかであり、ラビング布が配向膜１６の表面にほぼ均一に接触し、ラビング密度がほぼ均一になる。

【００３１】次に、パッシベーション膜２２、透明電極２３、保護膜２４、配向膜２５を形成した基板２１をシール材ＳＣを介して接合し、液晶２６を注入して液晶セルを形成する。液晶セルの上下に偏光板２７、２８を配置することにより、図１に示す液晶表示素子を完成する。

【００３２】（第２実施例）第１実施例では、第１のポストベイク処理のベイク温度を調整することにより、カラーフィルタの端部に形成するテーパーの角度を調整した。しかし、露光前のプリベイク処理（ステップＳ３）の温度を調整することにより、テーパーの角度θを調整することも可能である。この場合、第１のポストベイク処理は行わない。　図７は、カラーフィルタの膜厚が１．１±０．３μｍの場合のプリベイク温度とｔａｎθの関係を示す。図７に示すように、ベイク温度が上昇するに従ってｔａｎθが大きくなる。また、図７に示す特性はカラーフィルタの膜厚が厚くなるに従って上方に移動する。従って、カラーフィルタの厚さに応じて、プリベイク温度を調整し、所望のｔａｎθを得ることができる。

【００３３】なお、プリベイク温度と第１のポストベイクのベイグ温度とを共に調整することによりｔａｎθを調整してもよい。

【００３４】この発明は上記実施例に限定されず、種々の変形応用が可能である。例えば、カラーフィルタ１４をＲ→Ｇ→Ｂの順で形成したが、形成の順番は任意である。また、上記実施例では、パッシベーション膜１２を含む基板１１上にカラーフィルタ１４を形成したが、例えば、基板１１上にカラーフィルタ１４を直接形成してもよい。また、基板１１上に透明電極１５を形成し、その上にカラーフィルタ１４を形成してもよい。また、上記実施例では、カラーレジストをパターニングすることによりカラーフィルタを形成したが、無色のフォトレジストを、テーパーを有する形状にパターニングし、これを染色することにより、テーパーを有するカラーフィルタを形成してもよい。

【００３５】上記実施例では、カラーフィルタを用いた液晶表示素子として透過型の単純マトリクスタイプのものを例示したが、この発明のカラーフィルタは反射型或いはアクティブマトリクスタイプの液晶表示素子にも同様に適用可能である。

【００３６】

【発明の効果】以上説明したように、この発明によれば、カラーフィルタの端部にテーパーを形成し、且つテーパー角度を調整できるので、カラーフィルタ上に積層する透明電極の切断等が起こりにくく、配向膜の表面の凹凸が穏やかになり、その表面に施すラビングの強度がほぼ均一となり、ムラ等の表示欠陥の少ない液晶表示素子を提供することができる。

9

【図面の簡単な説明】

【図１】この発明の第１実施例にかかるカラー液晶表示素子の構造を示す断面図である。

【図２】１画素分のカラーフィルタの平面図である。

【図３】カラーフィルタの断面の拡大図である。

【図４】図１に示すカラーフィルタの製造工程を示すフローチャートである。

【図５】（Ａ）～（Ｄ）は、図１に示すカラーフィルタの製造工程を示す断面図である。

【図６】第１のポストベイクのベイク温度とテーパーの角度の関係を、カラーフィルタの膜厚別に示すグラフである。

10

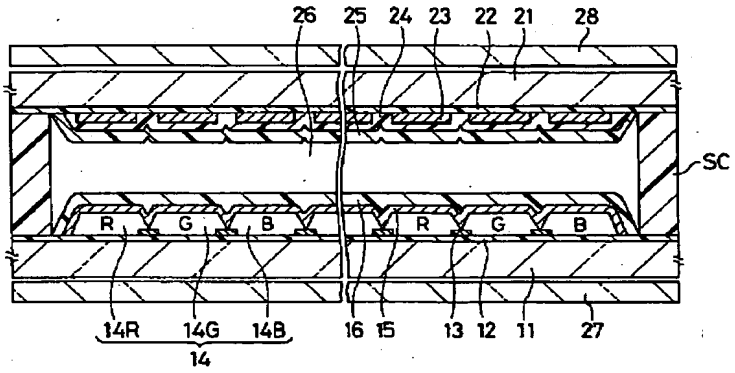
【図７】プリベイクのベイク温度とテーパー角度の関係を示すグラフである。

【図８】従来のカラーフィルタの断面構造を示す断面図である。

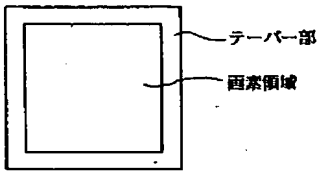
【符号の説明】

１１･･･基板、１２･･･パッシベーション膜、１３･･･ブラックマスク、１４･･･カラーフィルタ、１５･･･透明電極（ＩＴＯ）、１６･･･配向膜、２１･･･基板、２２･･･パッシベーション膜、２３･･･透明電極、２４･･･保護膜、２５･･･配向膜、２６･･･液晶、２７･･･偏光板、２８･･･偏光板、３１･･･カラーレジスト膜、３３･･･フォトマスク、ＳＣ･･･シール材

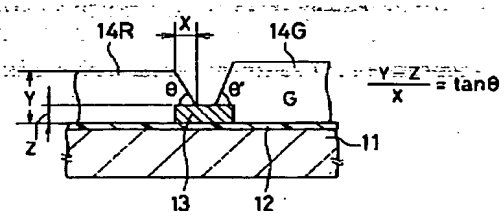
【図１】



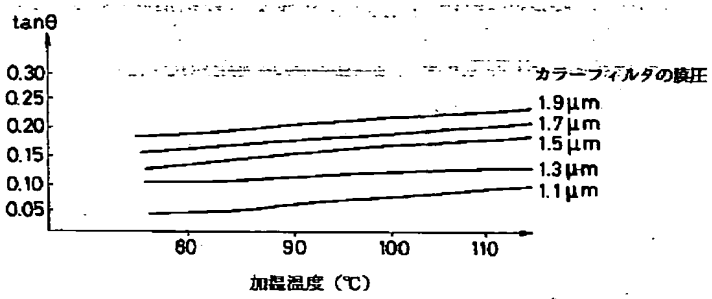
【図２】



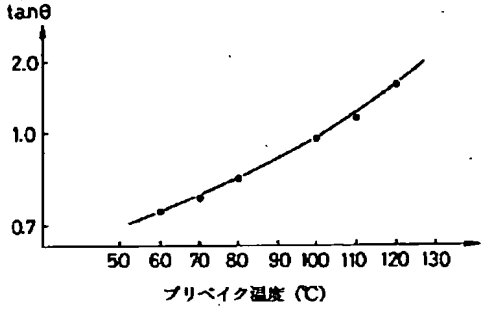
【図３】



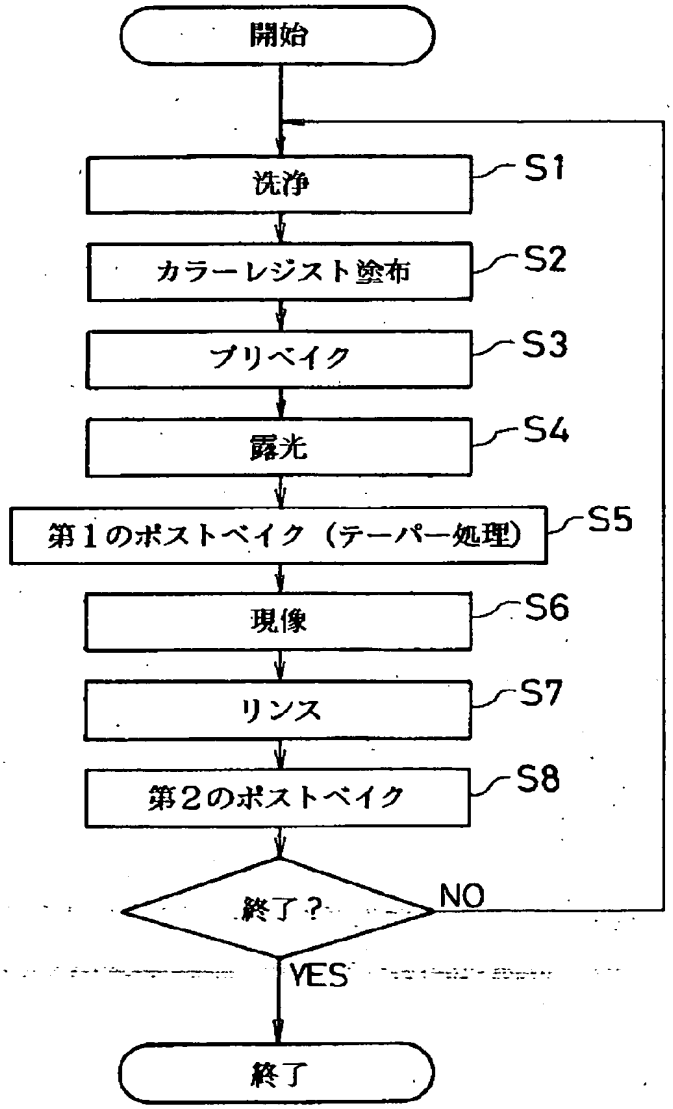
【図６】



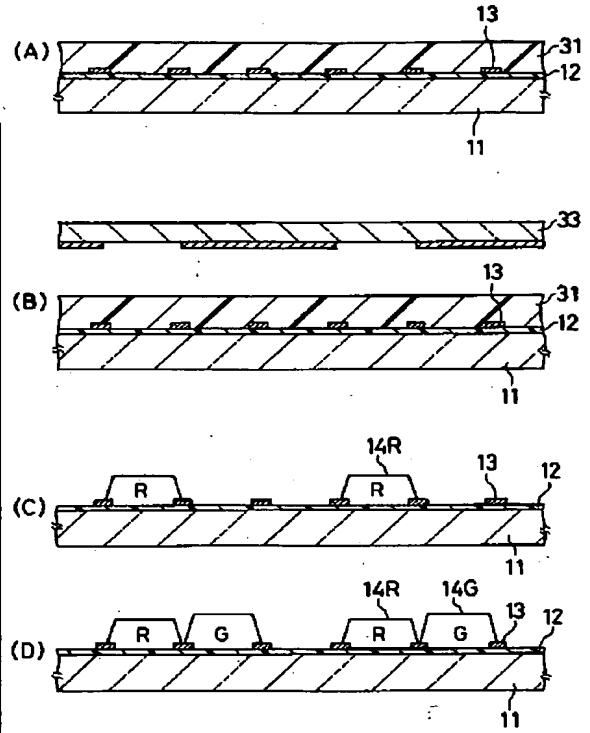
【図７】



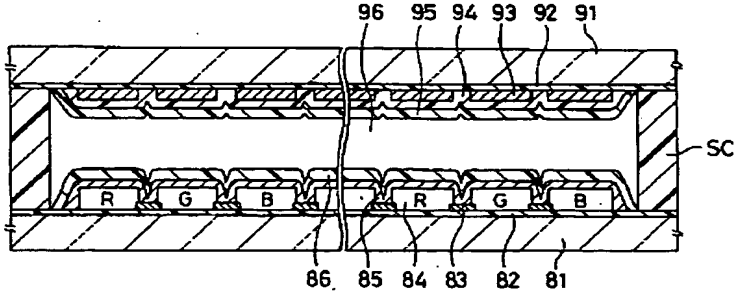
【図４】


開始
洗浄
S1
カラーレジスト塗布
S2
プリベイク
S3
露光
S4
第１のポストベイク（テーパー処理）
S5
現像
S6
リンス
S7
第２のポストベイク
S8
終了？
NO
YES
終了

【図５】


(A)
13
31
12
11
33
(B)
13
31
12
11
(C)
14R
R
R
13
12
11
(D)
14R
14G
R
G
R
G
13
12
11

【図８】


96
95
94
93
92
91
SC
R
G
B
R
G
B
86
85
84
83
82
81

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137-130

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이 출원에 대한 심사결과 아래와 같은 거절이유가 있어 특허법 제63조의 규정에 의하여 이를 통지하오니 의견이 있거나 보정이 필요할 경우에는 상기 제출기일까지 의견서[특허법시행규칙 별지 제25호의2서식] 또는/및 보정서[특허법시행규칙 별지 제5호서식]를 제출하여 주시기 바랍니다.(상기 제출기일에 대하여 매회 1월 단위로 연장을 신청할 수 있으며, 이 신청에 대하여 별도의 기간연장승인통지는 하지 않습니다.)

[이유]

이 출원의 특허청구범위 제1항 내지 제15항에 기재된 발명은 그 출원전에 이 발명이 속하는 기술분야에서 통상의 지식을 가진 자가 아래에 지적한 것에 의하여 용이하게 발명할 수 있는 것이므로 특허법 제29조제2항의 규정에 의하여 특허를 받을 수 없습니다.

[아래]

본원발명은 시인성을 향상시키기 위한 전기광학장치용 기판 및 그 제조방법에 관한 것으로서, 제1항 내지 제10항에 기재된 발명은 전기광학물질, 수지층을 구비하고, 수지층의 테이퍼가 복수의 서로 다른 각도를 갖는 것을 특징으로 하는 전기광학장치 및 전기광학장치용 기판에 관한 것이고, 제11항에 기재된 발명은 이러한 전기광학장치를 구비한 것을 특징으로 하는 전자기기에 관한 것이며, 제12항 내지 제15항에 기재된 발명은 이러한 전기광학장치용 기판의 제조방법에 관한 것입니다.

그러나 본원발명의 특징인 기판상에 마련된 수지층의 테이퍼가 복수의 서로 다른 각도를 형성하는 구성은 칼라필터 제조방법에 관한 일본공개특허 평08-327814호(1996.12.13 공개, 이하 인용발명1, 첨부1)에 나타나 있는 칼라필터의 테이퍼 각도가 칼라필터의 두께에 다라서 복수의 서로 다른 각도를 형성하는 구성과, 액정표시소자에 관한 일본공개특허 평09-068721호(1997.03.11 공개, 이하 인용발명2, 첨부2)에 나타나 있는 하부기판의 블랙 매트릭스는 작은 구배이며 절연성 수지로 구성되고 그 하부 절연막의 테이퍼 각도가 서로 상이하게 형

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[첨 부]

첨부1 일본공개특허 평08-327814호(1996.12.13) 1부.

첨부2 일본공개특허 평09-068721호(1997.03.11) 1부. 끝.

2005.10.28

특허청 **전기전자심사국**

영상기기심사담당관실 **심사관** **임현석**

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